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Biogeochemical properties of seawater measured from the icebreaker *Shirase* during the 55th Japanese Antarctic Research Expedition in the austral summer, 2013–2014

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1. Introduction

Biogeochemical properties of seawater have been routinely measured between Japan and the Japanese Antarctic Station Syowa (69°00′S, 39°35′E) as part of the monitoring program of the Japanese Antarctic Research Expedition (JARE), which is conducted each austral summer season (December–March) along regular routes across the Indian Ocean sector of the Southern Ocean. During JARE cruises, data have been collected both in the open ocean, and, since the 52nd JARE (2010–2011), in areas of sea ice off Syowa Station, Lützow-Holm Bay.

This report presents biogeochemical data acquired from the JARE-55 cruise (2013–2014). The dataset is composed of two series of data: (1) vertical profile data sampled at routine monitoring stations along a meridional transect at 110°E, 150°E, and data collected in Lützow-Holm Bay; and (2) surface water samples obtained along cruise tracks to confirm spatial variations in biogeochemical properties.

2. Sampling

Biogeochemical data presented in this report include temperature and salinity (measured by a sensor probe) and inorganic nutrients and chlorophyll *a* concentrations (measured by water analysis). All seawater samples and auxiliary data were taken from the icebreaker *Shirase* during the JARE-55 cruise. The sampling stations are shown in Figure 1.

2.1. Vertical profile sampling

Seawater samples and auxiliary data for vertical profiles were taken at monitoring stations along 110°E (L1–L5), 150°E (L6–L10), and in Lützow-Holm Bay (A–BP) in December 2013, March 2014, and February 2014, respectively. Sampling at station L2 (45°S, 110°E) was canceled because of rough seas, and sampling at station D (planned in the pack ice zone) was canceled due to an extremely narrow pack ice zone. At the time of sampling, station A was located in the multi-year fast-ice zone, and station B was located in the first-year fast-ice zone. Station C was located in the open ocean zone, although it was adjacent to the pack ice zone (Fig. 1). Station L10 was canceled by insufficiency of a ship time. Details of sampling in the sea-ice area are given in Takahashi *et al*. (2012, 2014).

Vertical temperature and salinity profiles were measured to a depth of 500 m using a conductivity–temperature–depth (CTD) memory probe (SBE 19 plus; Sea-Bird Electronics, Inc.) attached to a water sampler (SBE 55 ECO; Sea-Bird Electronics, Inc.). The data were downloaded from the CTD to a laptop computer immediately after each cast. The CTD sensor was calibrated by the manufacturer prior to the cruise. Note that the salinity data in this report were not corrected by the bottle salinity data measured by the salinometer.

Seawater was sampled to a depth of 400 m or to the bottom depth (whichever was less) during the down cast using a standard 4 L Niskin bottle (Sea-Bird Electronics, Inc.). Sampling was conducted at depths of 20, 50, 75, 100, 200, and 400 m at stations L1-L9 and C-BP, at 20, 50, 75, 100, and 150 m at station A, and at 20, 50, 75, 100, and 200 m at station B. Seawater at 0 m was collected from the deck using a 5 L polyethylene bucket.

Seawater was subsampled into 10 mL polyethylene screw-cap vials and 250 mL high density polyethylene (HDPE) screw-cap light blocking bottles to analyze concentrations of inorganic nutrients and chlorophyll *a*, respectively. After subsampling, seawater samples for nutrient analysis were immediately placed and stored in an ultra-low temperature freezer (−85°C) until analysis on land. Phytoplankton chlorophyll *a* was extracted by N, N-Dimethylformamide (Suzuki and Ishimaru, 1990) just after filtering the seawater using a glass fiber filter (Whatman, GF/F), and the samples were stored in a freezer (−18°C) until analysis on board.

2.2. Underway sampling

Underway surface water sampling was conducted during the cruise. Seawater was continuously pumped from 10 m below sea level to an on-board laboratory, and the inlet seawater temperature and salinity were quasi-continuously measured by sensor probes (SBE 38 for temperature and SBE45 for salinity; Sea-Bird Electronics, Inc.). Inorganic nutrients and chlorophyll *a* were analyzed from samples collected manually 2–3 times per day from the outlet of the laboratory; samples were treated in the same manner as those of the bottle samples collected in the vertical profiles.

3. Analysis

Concentrations of chlorophyll *a* were determined fluorometrically (Parsons *et al*., 1984) using an on-board fluorometer (10-AU; Turner Design, Sunnyvale). The fluorometer was calibrated against a chlorophyll *a* standard (Wako Chemical Co.) at a laboratory on land prior to the cruise, using a spectrophotometer and the specific absorption coefficient (Porra *et al*., 1989).

The samples for the nutrient concentration analyses were frozen and transported to a laboratory at Hokkaido University, Japan, via the National Institute of Polar Research, Japan. The frozen samples were thawed to room temperature starting the day before the analyses. Concentrations of the nutrients NO_3+NO_2, PO_4, SiO_2, and NO_2 were determined using an autoanalyzer (QuAAtro2-HR; BL-TEC K. K.), according to the World Ocean Circulation Experiment cruises method (Joyce and

Corry, 1994). The nutrient concentrations were calibrated against KANSO reference materials (BT, BF, BG, BS, and AZ; KANSO Technos Co., Ltd.).

4. Results

All information about sampling at the routine monitoring stations is listed in Table 1. Vertical profiles of temperature and salinity at each monitoring station are shown in Figure 2, and bottle analysis data, along with CTD data at defined depths, are listed in Table 2. Underway water sampling analysis data and sampling information are shown in Table 3.

5. Data archive

The data presented in this report are archived and available as csv file from web site (http://biows.nipr.ac.jp/JARE/). Permission to use these data for publication of presentation should be obtained in writing. Inquiries about details of the data record should be addressed to:

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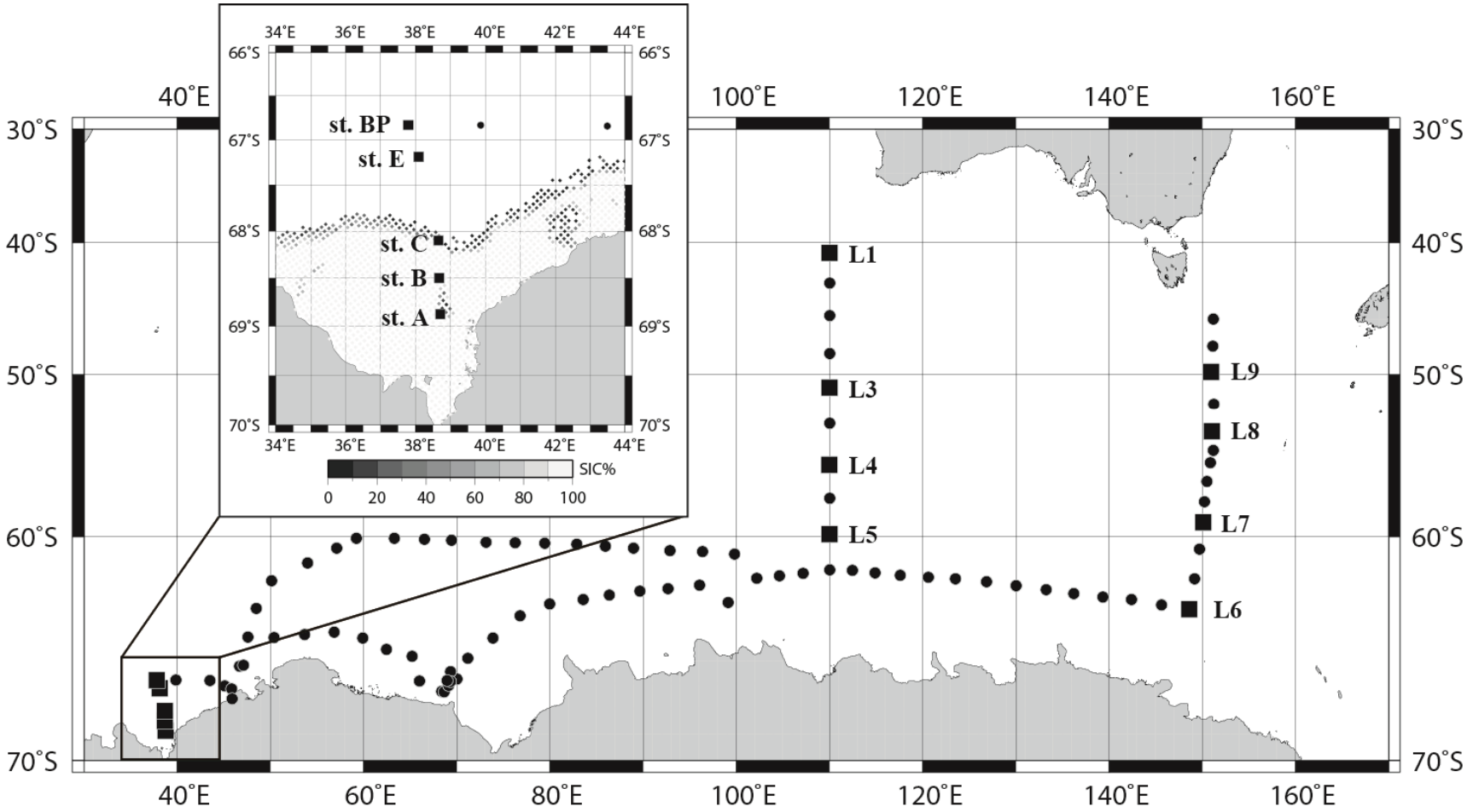

Fig. 1. Locations of sampling stations during the JARE-55 cruise. Solid circles indicate underway surface water sampling points. Solid squares indicate vertical sampling stations. SIC indicates the sea ice concentration (%) on 12 February 2014. The SIC data were obtained from Daily AMSR2 sea ice maps (http://www.iup.uni-bremen.de:8084/amsr2/).

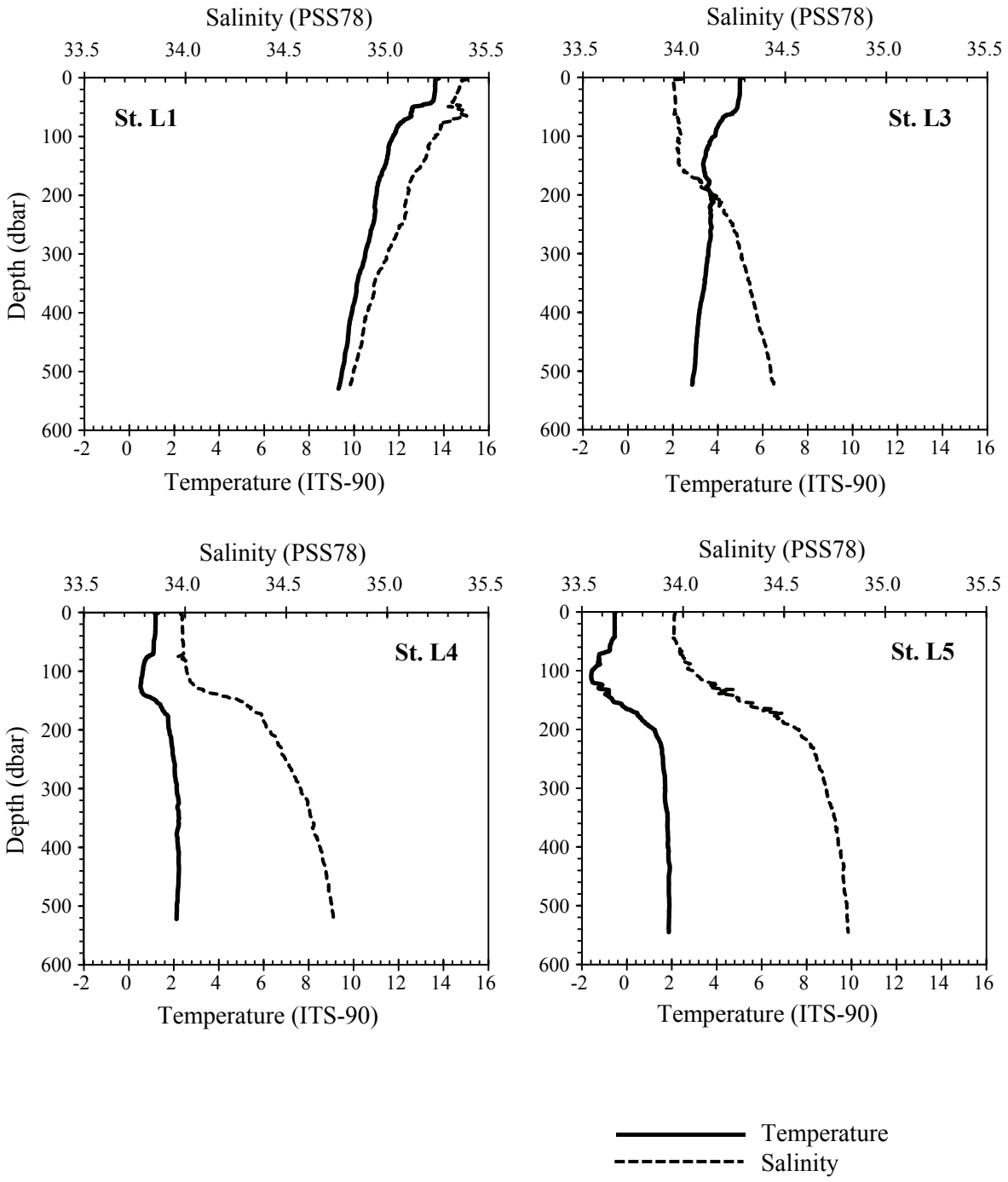

Fig. 2. Vertical profiles of temperature and salinity at each monitoring station.

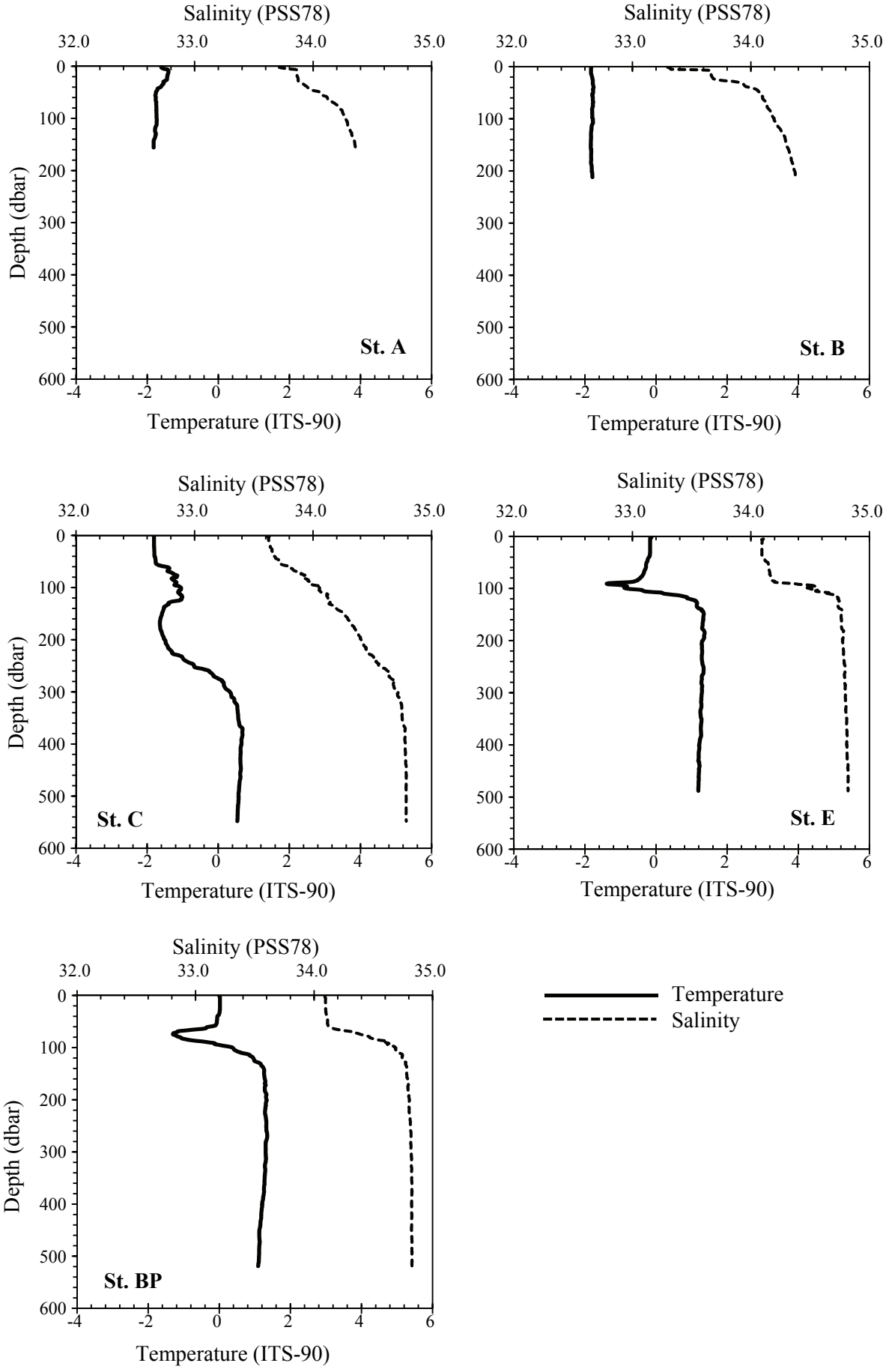

Fig. 2. Continued.

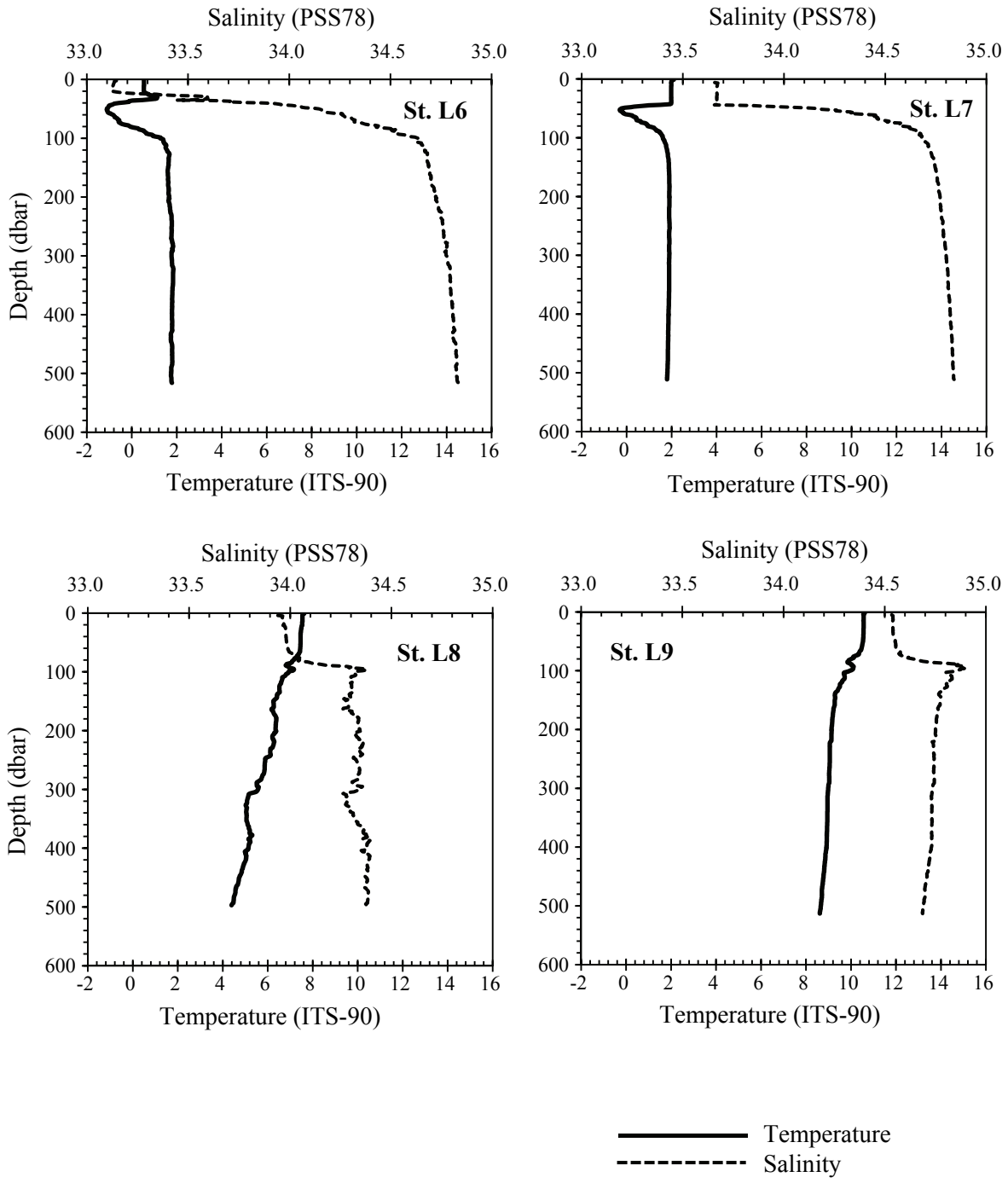

Fig. 2. Continued.

Table 1. Sampling date, time, position, bottom depth, air temperature, wind speed, and atmospheric pressure at each station.

Station	Date (UTC)	Time (UTC)	Latitude (°S)	Longitude (°E)	Bottom depth (m)	Air temperature (°C)	Sea surface temperature (°C)	Wind speed (m/s)	Atmospheric pressure (hPa)
L1	2013/11/29	1:00	40-50.48	109-59.79	4562	17.3	15.0	2.1	949.9
L3	2013/12/ 1	0:55	50-54.32	109-59.73	3222	4.1	6.5	0.5	1001.5
L4	2013/12/ 2	0:55	55-53.68	109-57.44	4178	1.2	3.7	3.1	995.8
L5	2013/12/ 2	20:55	59-50.68	109-59.73	4387	0.2	1.8	8.2	996.5
A	2014/ 2/ 9	5:30	68-52.51	38-42.67	167	−0.3	−1.6	4.1	977.8
B	2014/ 2/ 9	11:30	68-29.96	38-40.51	236	0.9	−1.6	5.1	980.7
C	2014/ 2/12	4:30	68-05.50	38-41.39	2842	−2.3	−1.8	8.7	988.9
E	2014/ 2/12	9:55	67-11.24	38-10.15	4306	−0.7	−0.1	10.3	988.2
BP	2014/ 2/12	14:50	66-49.89	37-49.91	4500	−0.1	0.2	5.7	988.0
L6	2014/ 3/ 6	4:55	63-39.79	148-34.80	ND	−4	0.6	3.1	974.2
L7	2014/ 3/ 7	21:53	59-13.32	150-07.12	ND	4.1	1.9	9.8	997.8
L8	2014/ 3/ 9	21:53	53-47.82	150-59.89	ND	10.0	7.5	12.9	1000.7
L9	2014/ 3/10	21:53	49-48.12	150-59.62	ND	11.6	10.5	6.7	1015.1

ND: No Data

Table 2. Conductivity–temperature–depth (CTD) and water analysis data at monitoring stations.

Station	Pressure	CTD data		Water analysis data				
		Temperature	Salinity	Nitrate	Nitrite	Phosphate	Silicate	Chl *a*
	(dbar)	(°C)		(μmol/L)	(μmol/L)	(μmol/L)	(μmol/L)	(μg/L)
L1	0(Bucket)	-	-	4.8	0.2	0.5	1.4	0.17
	19	13.6086	35.3545	4.6	0.1	0.5	1.4	0.14
	48	12.8552	35.2412	4.9	0.2	0.5	1.5	0.27
	73	12.2174	35.3062	5.9	0.3	0.6	1.7	0.46
	99	11.7574	35.2370	7.0	0.4	0.7	1.8	0.48
	198	11.0293	35.1002	9.3	0.1	0.8	2.1	0.06
	397	9.9640	34.8973	14.2	0.0	1.1	3.5	-
L3	0(Bucket)	-	-	21.8	0.3	1.5	3.0	0.54
	20	4.9832	33.9517	21.6	0.2	1.5	3.1	0.77
	49	4.8809	33.9574	21.6	0.2	1.6	3.3	0.77
	73	4.1857	33.9673	23.1	0.2	1.7	8.4	0.49
	99	3.8951	33.9830	23.8	0.2	1.8	10.9	0.24
	198	3.6816	34.1379	27.7	0.0	2.0	17.0	0.05
	398	3.2101	34.3574	32.9	0.0	2.3	36.7	-
L4	0(Bucket)	-	-	27.7	0.3	1.9	23.0	0.35
	20	1.1840	33.9861	27.7	0.3	1.9	23.2	0.36
	49	1.1139	33.9891	27.7	0.3	2.0	23.1	0.38
	75	0.9179	33.9627	28.0	0.2	2.0	23.9	0.35
	98	0.6370	34.0042	28.3	0.2	2.0	25.0	0.24
	196	1.7724	34.4056	35.1	0.0	2.5	56.1	0.01
	396	2.1999	34.6635	35.3	0.0	2.5	72.5	-
L5	0(Bucket)	-	-	29.0	0.3	2.0	35.8	0.39
	20	−0.5457	33.9551	38.7	0.3	2.7	49.6	0.37
	49	−0.6698	33.9637	34.2	0.3	2.4	43.5	0.44
	74	−1.2315	34.0023	30.9	0.2	2.2	40.3	0.45
	98	−1.4988	34.0298	30.7	0.2	2.2	41.4	0.37
	198	1.1278	34.5586	35.0	0.0	2.4	70.9	0.02
	397	1.8416	34.7713	33.8	0.0	2.3	81.9	-

Table 2. Continued.

Station	Pressure	CTD data		Water analysis data				
		Temperature	Salinity	Nitrate	Nitrite	Phosphate	Silicate	Chl *a*
	(dbar)	(°C)		(μmol/L)	(μmol/L)	(μmol/L)	(μmol/L)	(μg/L)
A	0(Bucket)	-	-	26.7	0.2	1.9	56.5	0.75
	20	−1.4351	33.8652	26.9	0.1	1.9	56.9	0.93
	50	−1.7543	34.0575	29.0	0.1	2.0	58.3	0.47
	74	−1.7462	34.2021	30.9	0.1	2.1	63.4	0.22
	99	−1.7378	34.2705	31.3	0.0	2.2	65.1	0.07
	149	−1.8182	34.3528	31.3	0.0	2.2	63.2	0.04
B	0(Bucket)	-	-	27.0	0.2	2.0	55.6	0.35
	20	−1.8036	33.6750	28.3	0.1	2.0	57.9	0.27
	50	−1.7731	34.0771	29.9	0.2	2.1	60.7	0.31
	74	−1.7767	34.1357	30.3	0.1	2.1	61.7	0.19
	99	−1.7896	34.2005	30.7	0.1	2.1	62.9	0.12
	199	−1.8052	34.3657	30.5	0.1	2.1	62.4	0.09
C	0(Bucket)	-	-	27.3	0.2	2.0	52.9	0.32
	20	−1.8067	33.6375	27.4	0.2	2.0	53.6	0.35
	49	−1.7629	33.7127	27.6	0.2	2.0	53.7	0.31
	74	−1.2653	33.8899	30.1	0.2	2.1	58.9	0.32
	98	−1.0814	34.0473	29.1	0.2	2.1	57.2	0.23
	197	−1.5257	34.4009	31.7	0.1	2.2	66.4	0.08
	400	0.6716	34.7770	33.1	0.0	2.3	94.4	-
E	0(Bucket)	-	-	29.3	0.2	2.1	58.1	0.13
	20	−0.2136	34.1245	28.3	0.3	2.0	55.8	0.14
	49	−0.2873	34.1764	28.3	0.2	2.0	54.7	0.22
	74	−0.5929	34.2151	28.8	0.2	2.0	57.2	0.29
	99	−0.8704	34.5218	32.9	0.0	2.3	74.6	0.11
	198	1.2772	34.7865	34.1	0.0	2.4	91.9	0.04
	398	1.2717	34.8247	33.3	0.0	2.3	97.6	-
BP	0(Bucket)	-	-	28.9	0.2	2.0	57.5	0.14
	20	0.0193	34.0972	28.1	0.2	2.0	54.9	0.12
	49	−0.0628	34.1130	28.1	0.2	2.0	55.2	0.15
	73	−1.2988	34.3931	33.6	0.1	2.4	72.1	0.34
	97	0.1166	34.7065	33.5	0.1	2.3	82.5	0.27
	198	1.3298	34.8039	33.6	0.0	2.3	93.0	0.01
	397	1.2291	34.8253	32.7	0.0	2.3	95.5	-

Table 2. Continued.

Station	Pressure	CTD data		Water analysis data				
		Temperature	Salinity	Nitrate	Nitrite	Phosphate	Silicate	Chl *a*
	(dbar)	(°C)		(μmol/L)	(μmol/L)	(μmol/L)	(μmol/L)	(μg/L)
L6	0(Bucket)	-	-	27.5	0.4	1.9	38.4	0.14
	20	0.5320	33.1248	29.1	0.4	2.0	40.8	0.12
	49	−1.0993	34.1473	35.4	0.2	2.6	56.8	0.24
	74	−0.5461	34.3767	32.0	0.2	2.3	56.9	0.33
	98	1.1652	34.6536	35.8	0.2	2.5	74.1	0.26
	198	1.6624	34.7313	36.3	0.0	2.5	84.8	0.02
	395	1.8036	34.8091	34.4	0.0	2.4	88.3	-
L7	0(Bucket)	-	-	29.5	0.4	2.0	31.8	0.39
	20	1.9791	33.6696	28.1	0.3	1.9	30.5	0.38
	49	0.0317	34.0286	37.8	0.2	2.8	65.4	0.81
	74	0.6579	34.5761	34.1	0.2	2.4	73.1	0.85
	99	1.6134	34.6794	35.4	0.2	2.5	79.9	0.40
	197	1.9042	34.7706	32.6	0.0	2.3	79.0	0.01
	396	1.8823	34.8216	33.6	0.0	2.4	85.2	-
L8	0(Bucket)	-	-	25.7	0.4	1.9	3.4	0.34
	19	7.5292	33.9682	20.9	0.2	1.5	2.6	0.34
	49	7.4598	33.9821	20.8	0.2	1.5	2.6	0.33
	73	7.3260	34.0206	22.9	0.3	1.7	3.1	0.35
	97	7.1535	34.3202	23.0	0.1	1.7	6.2	0.21
	199	6.3685	34.3415	30.0	0.0	2.1	11.6	0.01
	397	5.1819	34.3768	30.9	0.0	2.2	21.2	-
L9	0(Bucket)	-	-	10.8	0.3	0.9	0.3	0.81
	20	10.5607	34.5405	15.3	0.3	1.3	0.6	0.77
	49	10.5399	34.5521	10.0	0.2	0.8	0.3	0.73
	72	10.3308	34.5524	17.5	0.7	1.5	2.1	0.32
	99	10.0671	34.8407	17.1	0.1	1.3	4.2	0.05
	197	9.1593	34.7508	16.1	0.0	1.2	4.2	0.01
	399	8.9562	34.7317	16.9	0.0	1.3	4.2	-

Table 3. Sampling date, time, position, temperature, salinity, nutrient concentrations, and chlorophyll a concentrations for underway surface water samplings.

Station	Date (UTC)	Time (UTC)	Latitude (°S)	Longitude (°E)	Temperature (°C)	Salinity	Nitrate (μmol/L)	Nitrite (μmol/L)	Phosphate (μmol/L)	Silicate (μmol/L)	Chl *a* (μg/L)
S001	2013/11/29	13:00	43-15.40	109-59.81	-	34.7017	9.3	0.2	0.8	2.7	0.35
S002	2013/11/30	0:50	45-45.26	110-00.82	-	34.7305	9.3	0.3	1.0	3.3	0.41
S003	2013/11/30	13:00	48-31.02	110-00.13	-	33.9228	19.2	0.3	1.3	4.4	0.57
S004	2013/12/ 1	13:00	53-17.39	109-59.87	-	33.8309	25.1	0.2	1.7	13.6	0.71
S005	2013/12/ 2	11:30	57-51.71	110-00.00	-	33.9013	27.9	0.3	1.9	25.6	0.56
S006	2013/12/ 3	23:30	60-54.14	99-47.33	-	33.8545	26.9	0.3	1.8	32.7	1.20
S007	2013/12/ 4	7:20	60-46.77	96-22.66	-	33.8070	26.3	0.3	1.8	29.0	0.90
S008	2013/12/ 4	15:25	60-43.04	92-53.26	-	33.7131	26.1	0.3	1.7	35.0	0.91
S009	2013/12/ 5	0:30	60-35.07	88-58.09	-	33.7161	26.2	0.3	1.7	35.7	1.10
S010	2013/12/ 5	8:22	60-28.73	85-56.93	-	33.7971	30.0	0.2	2.1	51.3	0.44
S011	2013/12/ 5	16:00	60-22.34	82-51.56	-	33.8330	27.5	0.2	1.8	45.6	1.35
S012	2013/12/ 6	0:20	60-19.74	79-24.11	-	33.8060	28.0	0.3	1.9	37.1	0.73
S013	2013/12/ 6	8:00	60-18.16	76-15.43	-	33.7301	27.0	0.2	1.8	32.8	1.05
S014	2013/12/ 6	16:05	60-16.66	73-08.88	-	33.6897	26.7	0.2	1.8	30.4	0.77
S015	2013/12/ 7	1:40	60-10.64	69-26.89	-	33.5429	25.8	0.2	1.8	28.5	0.59
S016	2013/12/ 7	9:00	60-07.22	66-30.65	-	33.4791	26.3	0.2	1.8	31.3	0.32
S017	2013/12/ 7	17:00	60-03.70	63-17.58	-	33.5841	26.0	0.2	1.8	30.1	0.35
S018	2013/12/ 8	2:35	60-03.36	59-11.77	-	33.6151	26.1	0.2	1.8	31.6	0.39
S019	2013/12/ 8	9:35	60-35.30	57-07.18	-	33.7234	26.7	0.2	1.8	34.6	0.38
S020	2013/12/ 8	18:00	61-22.12	53-58.65	-	33.7485	27.3	0.3	1.9	39.5	0.21
S021	2013/12/ 9	2:30	62-15.34	50-06.91	-	33.5981	27.2	0.3	1.9	42.9	0.17
S022	2013/12/ 9	12:15	63-36.42	48-26.90	-	33.7015	28.2	0.3	2.0	48.9	0.19
S023	2013/12/ 9	19:15	64-56.19	47-34.46	-	33.8354	28.7	0.2	2.0	52.2	0.40
S024	2013/12/10	3:25	66-13.82	46-41.49	-	34.1120	30.4	0.1	2.1	60.1	0.46
S025	2013/12/10	10:50	67-05.28	45-04.04	-	-	30.4	0.1	2.1	61.0	0.39

Table 3. Continued.

Station	Date (UTC)	Time (UTC)	Latitude (°S)	Longitude (°E)	Temperature (°C)	Salinity	Nitrate (μmol/L)	Nitrite (μmol/L)	Phosphate (μmol/L)	Silicate (μmol/L)	Chl *a* (μg/L)
S026	2014/ 2/13	11:00	66-50.18	39-51.97	−0.3233	34.0157	30.3	0.2	2.1	58.3	0.22
S027	2014/ 2/13	19:00	66-50.81	43-29.38	−0.2805	33.9515	28.2	0.2	2.0	50.3	0.31
S028	2014/ 2/14	3:00	67-12.57	45-48.42	−1.7267	33.2748	26.3	0.2	1.8	49.9	1.41
S029	2014/ 2/18	6:00	67-37.02	45-51.24	-	-	26.0	0.2	1.8	51.0	0.75
S030	2014/ 2/20	19:00	66-11.68	47-04.87	−1.0684	33.5683	31.0	0.3	2.2	56.4	0.49
S031	2014/ 2/21	3:00	64-58.09	50-23.92	−0.0332	33.9069	27.9	0.3	1.9	46.6	0.38
S032	2014/ 2/21	11:00	64-49.99	53-38.86	−0.0367	33.8295	27.4	0.3	1.9	43.3	0.50
S033	2014/ 2/21	18:30	64-42.75	56-50.34	0.0835	33.7499	27.4	0.2	1.9	44.7	0.52
S034	2014/ 2/22	2:00	64-59.42	59-53.32	−0.1758	33.1166	26.7	0.3	1.9	44.0	0.25
S035	2014/ 2/22	10:00	65-30.32	62-25.40	−1.2978	33.1593	28.4	0.3	2.0	49.7	0.25
S036	2014/ 2/22	18:00	65-48.58	65-10.21	−0.4498	33.6467	30.9	0.3	2.2	53.9	0.18
S037	2014/ 2/23	2:00	66-52.86	66-00.51	−1.6385	33.4171	26.9	0.2	1.9	49.0	0.71
S038	2014/ 2/23	9:50	67-18.03	68-22.45	−1.6308	33.3564	27.0	0.2	1.9	49.8	1.28
S039	2014/ 2/23	18:00	67-19.33	68-38.78	−1.7506	33.4274	24.5	0.2	1.7	45.1	2.84
S040	2014/ 2/24	2:00	67-03.36	69-05.40	−1.8157	33.4268	25.1	0.2	1.7	47.6	0.82
S041	2014/ 2/24	10:00	66-47.08	70-01.74	−1.7026	32.7749	26.5	0.2	1.9	48.0	0.80
S042	2014/ 2/24	18:00	66-28.13	69-20.18	−0.7402	33.7188	28.2	0.2	1.9	46.6	0.31
S043	2014/ 2/25	2:00	66-53.02	69-20.06	−1.6461	32.8882	27.0	0.3	2.0	46.7	1.79
S044	2014/ 2/25	10:00	66-51.50	68-57.87	−1.6404	33.0731	27.2	0.2	1.9	46.0	2.18
S045	2014/ 2/25	17:30	65-53.34	71-09.00	−0.2509	33.6717	28.0	0.2	1.9	43.4	0.30
S046	2014/ 2/26	1:00	64-59.05	73-51.29	0.3131	33.4663	27.4	0.3	1.8	42.0	0.34
S047	2014/ 2/26	9:00	63-57.26	76-45.66	1.1102	33.6233	27.2	0.3	1.8	40.2	0.22
S048	2014/ 2/26	17:00	63-23.72	79-57.69	1.1837	33.7489	27.6	0.3	1.9	34.4	0.14
S049	2014/ 2/27	1:00	63-11.92	83-34.51	1.3064	33.7395	25.6	0.3	1.7	25.9	0.38
S050	2014/ 2/27	9:00	62-58.30	86-20.08	0.4613	33.3461	26.6	0.3	1.7	46.0	0.74

Table 3. Continued.

Station	Date (UTC)	Time (UTC)	Latitude (°S)	Longitude (°E)	Temperature (°C)	Salinity	Nitrate (μmol/L)	Nitrite (μmol/L)	Phosphate (μmol/L)	Silicate (μmol/L)	Chl *a* (μg/L)
S051	2014/ 2/27	16:30	62-46.91	89-37.20	1.3322	33.6832	24.8	0.3	1.6	36.7	1.91
S052	2014/ 2/28	0:00	62-38.88	92-38.57	1.3380	33.7281	25.8	0.3	1.7	42.2	1.54
S053	2014/ 2/28	8:05	62-28.60	96-02.54	0.7995	33.5762	26.8	0.3	1.8	48.0	0.19
S054	2014/ 2/28	15:30	63-19.78	99-05.44	1.5787	33.6032	23.3	0.3	1.5	26.2	0.59
S055	2014/ 2/28	23:00	62-08.65	102-09.65	1.6125	33.5526	22.9	0.3	1.5	23.9	2.62
S056	2014/ 3/ 1	7:00	62-01.06	104-37.97	2.0316	33.5622	23.8	0.3	1.5	23.8	1.85
S057	2014/ 3/ 1	15:00	61-53.12	107-08.16	2.5983	33.7928	25.1	0.3	1.7	20.6	0.85
S058	2014/ 3/ 2	0:30	61-43.39	110-00.43	1.5807	33.4849	25.5	0.3	1.7	31.2	1.35
S059	2014/ 3/ 2	8:00	61-44.21	112-25.48	1.8538	33.3727	24.8	0.3	1.7	29.5	1.71
S060	2014/ 3/ 2	15:00	61-52.21	114-53.57	2.1957	33.6167	25.2	0.3	1.8	24.0	0.54
S061	2014/ 3/ 2	22:00	61-58.89	117-33.50	2.2641	33.6567	24.6	0.3	1.7	14.5	0.44
S062	2014/ 3/ 3	6:00	62-05.21	120-34.98	2.2370	33.6500	24.3	0.3	1.6	16.4	0.39
S063	2014/ 3/ 3	14:00	62-10.02	123-30.44	2.4205	33.5798	23.1	0.3	1.5	13.9	0.81
S064	2014/ 3/ 3	22:00	62-19.01	126-49.11	2.4113	33.6369	23.9	0.3	1.6	14.3	0.32
S065	2014/ 3/ 4	6:00	62-30.58	130-01.42	2.9789	33.6761	24.5	0.3	1.7	14.6	0.24
S066	2014/ 3/ 4	13:30	62-42.72	133-14.21	2.3908	33.7236	25.4	0.3	1.7	9.8	0.27
S067	2014/ 3/ 4	21:00	62-53.48	136-13.53	1.8404	33.6592	24.3	0.3	1.5	11.5	0.56
S068	2014/ 3/ 5	5:00	63-03.53	139-18.10	1.7249	33.5709	25.0	0.3	1.6	19.2	0.80
S069	2014/ 3/ 5	12:30	63-11.82	142-24.52	1.5739	33.6137	24.6	0.3	1.6	14.7	0.47
S070	2014/ 3/ 5	20:00	63-26.79	145-37.65	1.5907	33.5226	24.2	0.3	1.5	17.4	1.30
S071	2014/ 3/ 6	21:00	62-09.81	149-09.40	2.1955	33.5399	25.3	0.3	1.6	13.3	0.52
S072	2014/ 3/ 7	8:00	60-39.40	149-41.90	2.2121	33.5306	24.6	0.3	1.6	13.4	0.51
S073	2014/ 3/ 8	9:00	58-03.09	150-13.37	3.2332	33.5996	24.7	0.3	1.6	13.3	0.39
S074	2014/ 3/ 8	19:00	56-52.45	150-30.16	3.5184	33.5397	24.3	0.3	1.5	6.8	0.28
S075	2014/ 3/ 9	6:00	55-46.12	150-51.25	6.2644	33.7338	22.7	0.2	1.5	1.5	0.36

Table 3. Continued.

Station	Date (UTC)	Time (UTC)	Latitude (°S)	Longitude (°E)	Temperature (°C)	Salinity	Nitrate (μmol/L)	Nitrite (μmol/L)	Phosphate (μmol/L)	Silicate (μmol/L)	Chl *a* (μg/L)
S076	2014/ 3/ 9	14:09	55-00.01	151-10.11	7.5184	33.8358	21.0	0.2	1.4	2.6	0.33
S077	2014/ 3/10	9:15	52-00.43	151-13.31	10.6650	34.3121	10.9	0.2	0.8	0.8	0.66
S078	2014/ 3/11	7:37	48-00.04	151-05.99	11.9986	34.6050	7.1	0.2	0.6	1.1	1.34
S079	2014/ 3/11	16:35	46-00.02	151-12.30	15.0406	34.9951	1.5	0.1	0.2	0.6	0.85